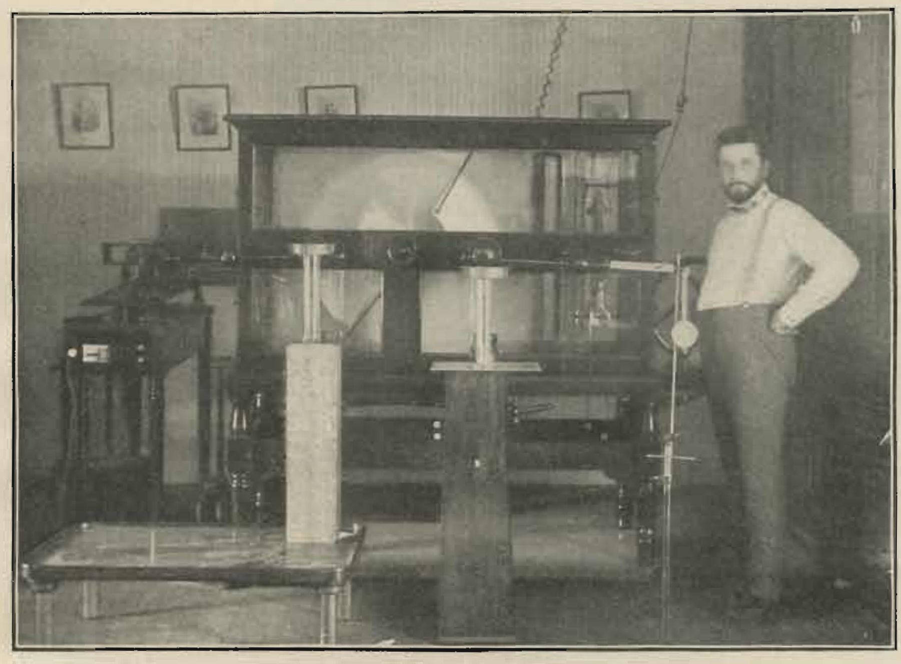
ELMER GATES AT WORK IN HIS LABORATORY AT CHEVY CHASE.



MAKING RAIN BY ELECTRICITY.

THE REMARKABLE DISCOVERIES OF ELMER GATES—HOW SHOWERS AND THUNDERSTORMS ARE MADE IN THE LABORATORY—A NOTABLE ADVANCE PROMISED IN PREDICTING WEATHER CHANGES.

By Clifford Howard.

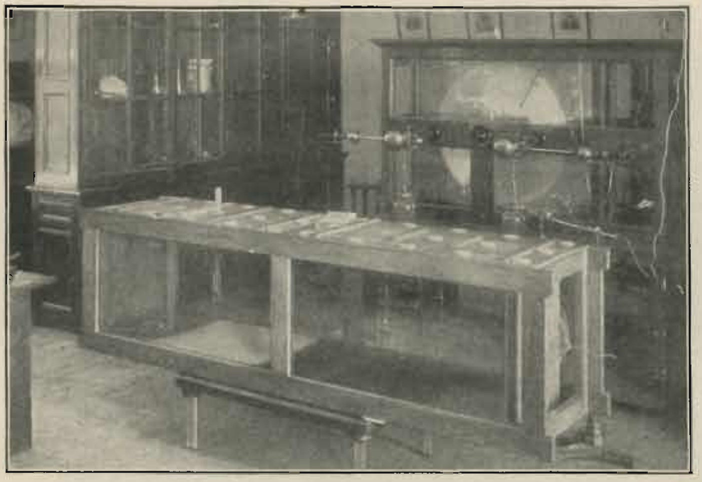
ELMER GATES, of Washington, D. C., has recently made experiments that go a long way toward solving the riddle of the weather. In his laboratory at Chevy Chase, a suburb of the National Capital, he lays bare many of the phases of this long-cherished secret of nature and answers the problem that for ages has been a mystery to mankind: What is the cause of the weather?

His answer is *Electricity!* And with this subtle and all-powerful force at his command, he produces at will in his laboratory all of the various manifestations of weather—high and low barometer, dryness, moisture, rain, lightning, water-spouts, etc.—and makes clear the methods by which nature accomplishes her work; revealing thereby the marvellous fact that the human race owes its very existence to electricity as the vital source of all weather conditions; the producer of the rain and the sunshine and the changes of temperature upon which the life of the world depends.

One of the most striking features of his demonstrations is their simplicity. Suspending a large fluffy ball of cotton from the ceiling by means of a dry silk thread, he charges it with electricity from a powerful electric machine. As he does so the ball grows perceptibly larger, the electricity causing the fibres of the cotton to repel one another.

In this simple and familiar experiment, explains Gates, we have a demonstration of the cause of low barometer, the sign of bad weather.

You look incredulous. What has a ball of cotton to do with the weather?



GLASS BOX USED TO DEMONSTRATE THAT MOISTURE FLOWS FROM THE POSITIVE TO THE NEGATIVE POLE.

Simply this: It shows that when an expansible body is electrified it spreads out and becomes less dense. Now, that is precisely what takes place when a quantity of air is charged with electricity. It becomes lighter, its pressure is reduced; and this is directly proved by placing an open bulb in the centre of the cotton ball and collecting the electrified air, which, upon measurement, is found to be appreciably lighter than the surrounding air of the room. When, therefore, a mass of air over any particular region of the world becomes charged with atmospheric electricity its density is diminished, its pressure grows less, and the result is that the barometer goes down.

But how about a high barometer? Does electricity cause good weather as well as bad?

For answer Mr. Gates suspends a second cotton ball about two feet from the first. In a short time you will notice the two balls approaching one another through electric attraction, and as they come nearer together you will see that each of them is growing smaller.

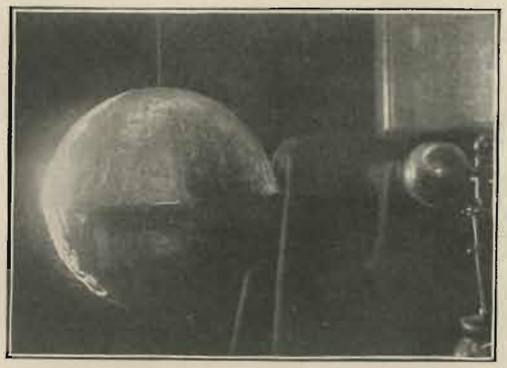
Here you have a phenomenon exactly the reverse of the other; and applied to the weather it demonstrates that when two masses of air of opposite electricity approach one another they become denser, there is an increase of atmospheric pressure, and consequently the barometer goes up.

But what is of special importance is the fact that when one mass of air becomes electrified it is bound sooner or later to induce an opposite charge in some neighboring mass of air, just as the first cotton ball did with the second, in accordance with well-known principles of electricity, and the result is that they are then mutually drawn toward one another, increasing in density as they do so. Thus "lows" and "highs" follow one another as a natural sequence; bad weather being in reality the cause of the good weather that follows; and so the merry-go-round of storm and sunshine goes on forever.

Now, if electricity is the cause of changes in the density of the atmosphere, why not make daily observations of the electric conditions of the air and thus be able to predict when and where high and low barometer will occur?

Gates sees no reason why this should not be done. Nowadays the Weather Bureau is obliged to wait until the changes in the barometer actually occur before the official predictions can be made. According to the proposed method, forecasts could be prepared days in advance; and Gates is now at work, during his spare time, devising an instrument to be used in making meteorological observations at great heights.

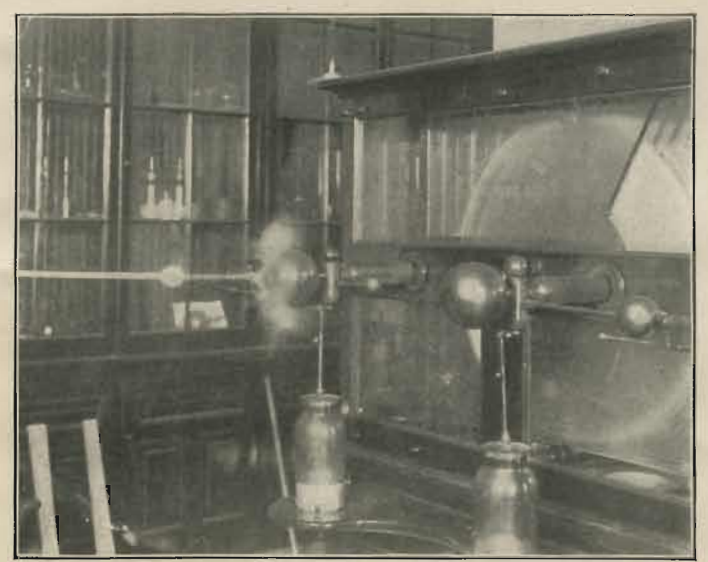
It is a machine that propels itself through the air and returns safely with the self-



APPARATUS USED TO DEMONSTRATE ELECTRICAL EFFECT OF THE SUN UPON THE EARTH.

recording instruments that it carries with it. It has already ascended to a height of nine miles, and its inventor expects it to reach even greater altitudes; thus enabling him to explore regions of the air that heretofore have been inaccessible.

In the large electrical room of his laboratory he opens two windows, eight feet apart, on the south side of the room. By means of an electric fan placed at one of the north windows the air is driven out of the room, so that the only air entering it shall be that which comes from the outside through the two open windows. The two currents of air are made visible by placing a pan of smoking substance on each window sill. One of the currents is charged now with negative electricity and the other with positive from the electrical machine, and the phenomenon shown in the cotton balls is here repeated as in nature; the two masses of air approaching one another and mingling together almost as soon as they enter the room.



SMOKE GOES DIRECT TO NEGATIVE KNOB OF MACHINE AS SOON AS ELECTRICITY IS GENERATED.

But now follows the most astonishing part of the experiment. The day chosen for it is one on which the atmosphere contains a large amount of moisture. Now, when the two currents of air mingle after entering the windows you will notice a slight mist forming where they meet, and in a short time you will see that the floor beneath is wet. In other words, it is raining! —raining in the laboratory, while the weather outside is bright and clear.

If the two currents of air are not electrified they do not mingle until they cross the room, and there is no sign whatsoever of rain, mist, or moisture.

It is evident, therefore, that the formation of rain is due to electricity, and what has taken place here before you in the laboratory is a reproduction in miniature of what takes place in nature. It is the coming together of electrified masses of moisture-laden air that gives us our showers and our rains.

And when these masses of air or clouds are very heavily charged with electricity we have also thunder and lightning and other stormy conditions, as may be seen by watching the action of the two cotton balls. If they are highly charged they will spring together with a spark and a snap; then separate and come together again, if the charge is still maintained; keeping it up until the electricity has spent itself and equilibrium is restored.

While explaining these facts, Gates injects a quantity of black smoke into one of the cotton balls and charges the ball with electricity from the positive pole of his machine. No sooner is this done than the smoke comes out of the ball and proceeds in a straight line to the other ball.

Before explaining the significance of this phenomenon, he lights a piece of camphor gum, and, placing it four or five feet away from the electric machine, the smoke from the burning camphor goes straight to the negative pole of the machine.

In these experiments, he tells you, we have a visible demonstration of the fact that electricity is capable of transporting material substance. In each of these experiments it carries smoke a distance of several feet through the air, from the positive to the negative pole. And herein lies an explanation of the manner in which electricity carries moisture from one place to another.

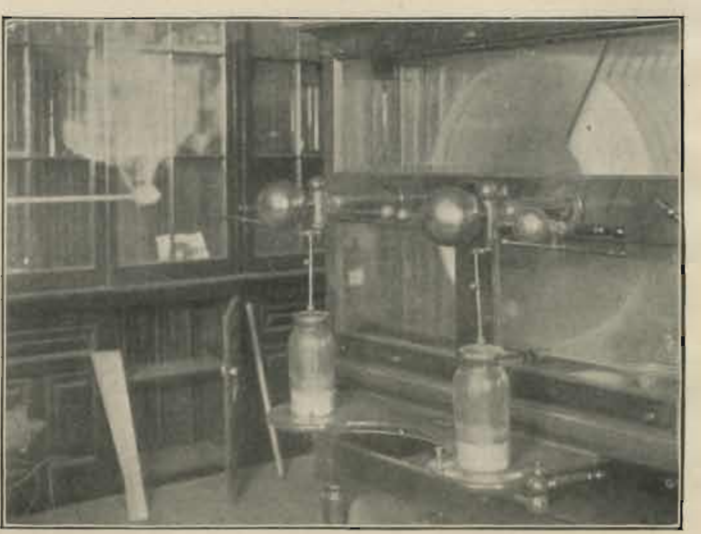
In one end of a glass box about eight feet long, he places a quantity of air heavily charged with moisture, while the other end is supplied with very dry air; the two compartments being separated by a partition of thin and very porous paper. When left undisturbed it requires several hours for the moisture to diffuse itself through the box. But note what happens when the end containing the dry air is connected with the negative pole of the electric machine and the moist air is charged from the positive pole. Inside of a few minutes the moisture will be found to have gone over to the opposite end of the box!

"Now let me show you a still more practical application of this phenomenon;" and as he speaks Gates brings forward a small box of growing plants. "The earth I put into this box was perfectly dry; so dry that the seeds I planted would not sprout. I placed it here, in this large room, and gave the seeds no water or moisture whatsoever, and the result was that they did not come up. At the expiration of a couple of weeks I connected the box with the negative pole of the electric machine and charged the air of the room with positive electricity. What was the result? The earth in the box became moist and the seeds sprouted within the next two or three days.

"The experiments I have made with this phase of the subject all go to prove that moisture flows from the positive to the negative pole; and by means of a crucial experiment of great importance I have found that water evaporates more quickly when charged with positive electricity."

These particular discoveries of Gates solve a problem that has long been a puzzle to weather observers, who have noted that very frequently more rain will fall in a given region than could possibly be contained in the clouds within the rain area. But, as just said, these experiments of Gates clear up the mystery. They show that moisture may be carried from one region to another; so that while it is raining in one place large quantities of vapor may be flowing to that particular locality from surrounding regions where the weather is clear. With nature's tremendous forces in operation this transportation of vapor from one place to another may ofttimes involve distances of hundreds of miles and rates of speed far in excess of moving clouds or wind.

"Perhaps you know," continues the scientist, "that a current of air is continually streaming from any sharp point charged with electricity. Now, it is not carrying the deduction too far to suppose that under similar but vastly more powerful charges of the earth's surface, currents of air may be carried from sharp peaks or points upward into the higher strata of the atmosphere; and likewise, when such a discharge takes place downward, it may carry a current from higher to lower regions, thus producing cyclones, whirlwinds, water spouts, and other phenomena of the same kind, due to the meeting and twisting of opposite currents. Let me show you an artificial water spout produced on this principle."



SMOKE FROM BURNING CAMPHOR, ON END OF GLASS TUBE, ASCENDS WHEN ELECTRIC MACHINE IS NOT IN OPERATION.

He secures a saucer of water and connects the bottom of it with one of the poles of the electric machine. Then taking

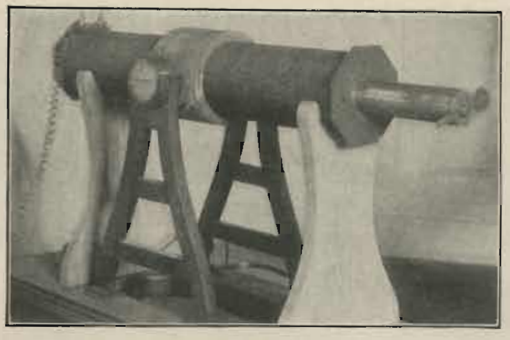
A REAL CYCLONE.

From a photograph in the possession of the United States Weather Bureau—the only one ever taken successfully.

a rod charged from the opposite pole he holds it above the surface of the water. At first the water becomes agitated; then it begins to gather and rise in the centre, and finally, as the charge is increased, it forms itself into a spout and rises bodily in the shape of a conical column and touches the rod held above it.

Whatever the phase of the weather, whatever the action of the elements, Gates's experiments prove that electricity is primarily the cause of it; that all meteorological phenomena, from the calm of a summer's day to the tempestuous storms of the equinox, are nothing more nor less than manifestations of electricity.

But where does all this electricity come from? The amount of electrical force represented in a single thunder storm or a cyclone is beyond all calculation. Then where does it come from? What is the source of this ever-present, never-ending power that produces the constant changes in the weather throughout the world, day after day, year after year, and age after age, without cessation and without diminution?



INSTRUMENT TO DEMONSTRATE CAUSE OF EARTH'S ROTATION ON ITS AXIS.

When the arm, to which is attached a movable metal disk, is revolved on its pivot in front of the large bar, the disk rotates on its axis at the same time, if the large bar is magnetized. But if the electricity is cut off, so that this bar is non-magnetic, the disk remains stationary while revolving around the bar on the end of the arm.

The answer is a startling one. It opens the way to the borderland of one of the great mysteries of our solar system. It brings you face to face with possibilities of stupendous import. It is nothing more nor less than that the earth is a gigantic electric-producing machine. Our world, in common with the sun and the other planets, is not only a vast generator of electricity, but is also kept in motion and controlled by electrical forces.

"I prove by experiment," says Gates, in explanation of this wonderful phase of his discoveries, "that when an insulated body is revolved before a magnet it produces electricity upon itself. Now, the earth is an insulated body and revolves in an intense magnetic field produced by the sun, the great central magnet of our solar system. The earth is insulated because the air that envelops it is a nonconductor, and for that reason the electricity generated by the revolution of the earth is not thrown off, but is retained and manifests itself in what we call the weather."

"And you say that the rotation of the earth on its axis is an electrical phenomenon also?"

"Yes; such a conclusion is rendered probable by my experiments. Not only the rotation on its axis, but its revolution, too, about the sun is the result of electricity or electro-magnetic action. We know that the sun rotates on its axis. Now, I find by experiment that when a magnet rotates it causes magnetic bodies within its influence to revolve about it. The nearer they are to the magnet the faster they revolve, and this is precisely what we observe in the case of the planets. And I have also discovered that a sphere revolving about a magnet turns on its axis. This is due to the fact that the side nearest the magnet is slightly retarded by the effect of the attraction, and this causes the globe to rotate while moving in its orbit around the magnet. So we see that the sun by its own motion causes the earth to revolve about it and that this in turn produces the rotation of the earth on its axis, which gives us our atmospheric electricity."

"Then meteorology and astronomy are closely related?"

"Certainly. You cannot separate the one from the other. It is quite probable that astronomical observations and calculations will soon constitute one of the factors of weather forecasts. We already know that the positions and the motions of the earth have a general effect upon the weather, as in the changes of day and night and the different seasons; but we will be able to go farther and make more definite predictions, based upon the state of the earth's electricity, which is subject to modifications through a number of astronomical causes. Let me give you an illustration of how another planet, for example, may affect the electrical conditions of our sphere."

He takes a large paper globe, insulated with shellac, and suspends it by a silk thread in the vicinity of a powerfully charged positive pole of the electric machine. The knob of the machine represents the sun, and the paper globe the earth. By induction the earth becomes charged with negative electricity, and the amount of it is measured. Then, between the earth and the sun is placed a planet in the form of another paper globe. The effect of this is a perceptible increase in the electricity of the earth. If the planet is now moved to the opposite side of the earth, away from the sun, the earth's electrical charge diminishes.

By this curious and significant phenomenon you have an indication of how the planets in their relative positions toward the earth may affect its electrical conditions, and how by careful observations it may be possible to definitely determine these conditions and their results.

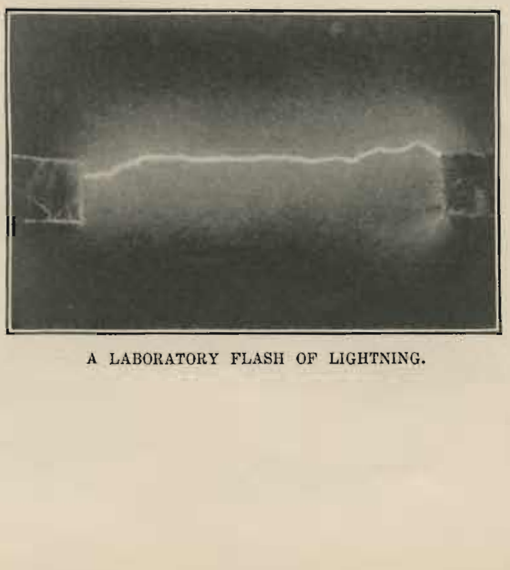
Gates has planned and expects soon to make an instrument to measure and record atmospheric electricity. This, in conjunction with the machine already alluded to, and in conjunction with the knowledge he has gained for the world in these remarkable discoveries of his, is destined to revolutionize the study of meteorology and make it possible to predict the weather upon scientific principles as true and as certain as those that now guide the astronomer in his calculations. So that before long we may have official forecasts of the weather for many days in advance, and forecasts that may be relied upon with far more certainty than those which Uncle Sam gives us from day to day under the present system.

Strange as it may seem, Gates has not undertaken these investigations because of any special wish to unravel a mystery that has been bothering the human race since the days of Noah, nor because of a desire to add to his reputation, but merely for the purpose of studying the mental processes by which scientific discoveries are made.

Gates is preëminently a psychologist. His life work is devoted to a study of mind, and his laboratory at Chevy Chase is large and thoroughly equipped for his own special lines of research. It consists of a number of buildings fitted up with all that pertains to the practical investigation of science, and here, with a corps of assistants and employees, he pursues his studies and experiments in a domain of investigation that will ultimately embrace all branches of knowledge.

Though he is only a little over forty years of age, he already has to his credit a long list of valuable inventions, as well as a number of scientific discoveries. All of these are the result of experimental researches made for the purpose of determining the conditions under which the mind works out the problems of invention and discovery. This is done in order to learn how the mind may best be trained to accomplish such results. He is never as much interested in the discovery or the invention itself as he is in the intellectual and subconscious processes by which it is produced.

At the same time it is his intention to eventually establish various scientific departments in his laboratory for the purpose of carrying out to practical application the discoveries resulting from his investigations. The nucleus for a meteorological department is already established, consisting of the apparatus and appliances used in his experiments and of a large collection of rare and valuable books on meteorology, donated by the late Professor Henry A. Hazen, of the United States Weather Bureau, who took a very active and enthusiastic interest in Gates's investigations of the subject and was the first to recognize and declare the importance of the discoveries that these investigations have produced.



A LABORATORY FLASH OF LIGHTNING.

THE VOICE OF SLANG.

By William J. Lampton.

Permit me to present myself:
I am Slang,
The so-called inelegant and unauthorized
Expression of current concepts,
Low in origin,
But high in popularity,
And my pertinence
Precludes the possibility
Of punitive proscription,
As my prevalence
Prevents prohibition.
In less elaborate language,
I am a superior substantiality;
Exert your powers of propulsion
Upon my progress.
I do not emanate
From the well of English
Pure and undefiled,
Because it is my mission
To remain in that
Glossologic reservoir
And keep its waters
Thoroughly agitated;
And I accomplish my purpose
To the gustatory admiration
Of the feminine sovereign.
Possibly I may be lacking
In Addisonian elegance,
But I arrive at destination
With identical simultaneousness,
Which is the object of my presence;
While for ordinary colloquial ends,
I may say, without fear
Of successful contradiction,
That I am
A feathered denizen of the forest.
I am the universal tongue,
For I am in everybody's mouth,
And the individual
Who does not know Slang
Argues himself unknown.
I live in the lines of the novel,
I glisten in poesy,
And the columns of daily papers
Are brilliant by reason of me;
The lips of the maid and the matron
I may kiss whenever I please,
And the dignified doctor and lawyer
Embrace me with lover-like ease;
The high and the low are my subjects,
The cultured and vulgar are mine,
And the students of every known college
Accept me as something divine;
In other words,
I am in the propulsion,
And if you recognize
An estimable entity
When it falls within
The angle of vision,
You will be exigent
In placing yourself
In juxtaposition to me.
As a decorator of diction
I am the only geologic formation
On the sandy margin
Of the sea;
And, if I do not possess
The terrestrial sphere,
I compel it to speak my language.
Homer and Virgil and Milton
Were not dilatory,
But I am conscious
Of my conversation
When I say
If the Iliad and the Æneid
And Paradise Lost
Had been written according
To my style,
They would have been beyond
The horizon of ocular demonstration,
And don't you let
The waters of Lethe
Obliterate it.
However, if I continue
To aërate my personality
With calefied atmosphere,
You may infer that
I am agglutinated on myself,
So I will merely add
That I am the Neuter Pronoun
Of modern expression
And permit it to proceed
With that understanding.
See?
Are you on?
Do you tumble?
What are you going to do about it?